

WHAT IS CLAIMED IS:

1. A system for the continuous liquid phase modification and/or conjugation of proteins, purification and concentration thereof which comprises
an ultrafiltration concentration means;
a reaction vessel being fluidly connected to said ultrafiltration/concentration means; and
a pump being fluidly interconnected between said ultrafiltration/concentration means and said reaction vessel.
2. The system of claim 1, further comprising a backwash reservoir which is interconnected with said ultrafiltration concentration means.
3. The system of claim 1 wherein at least one three-way valve is fluidly and selectively interconnected and situated between said reaction vessel, said ultrafiltration/concentration means and said backwash reservoir.
4. The system of claim 1 wherein said ultrafiltration means comprises a spiral diafiltration cartridge.
5. The system of claim 1 wherein the ultrafiltration means is interconnected to a permeate reservoir/receptacle.

6. The system of claim 1 wherein said reaction vessel is a receptacle of the purified concentrated product from said ultrafiltration/concentration means.

7. A method for conjugating a protein molecule to another molecule and purifying the conjugated product thereof, comprising the steps of:

(a) conjugating a protein molecule to another molecule in a liquid reaction mixture so as to form a mixture of conjugated and unconjugated protein and other molecules;

(b) passing the liquid reaction mixture composed of conjugated and unconjugated protein and other molecules through said ultrafiltration means thereby retaining the conjugated protein molecules in said ultrafiltration means and passing the unconjugated molecules into a permeate reservoir;

(c) washing the isolated conjugated protein molecules in the ultrafiltration means with a suitable desalting solution or another buffer solution;

(d) backwashing the ultrafiltration means with the buffer to release the washed conjugated protein molecules from the ultrafiltration means;

(e) purifying the conjugated protein molecules by repeating the steps c) and d) until the conjugated protein

molecule is substantially free of the non-conjugated molecules; and

(f) recovering the conjugated protein molecule from the ultrafiltration means.

8. A method for purifying the protein reagent in a liquid mixture which comprises passing the liquid mixture over a semipermeable membrane of sufficiently small pore size contained in an ultrafiltration apparatus, so as to selectively retain the protein on the membrane; washing the retained protein on the membrane; backwashing the protein from the membrane with washing liquid, and harvesting the washing liquid containing the retained protein.

9. The method for purifying a protein according to claim 8, wherein the protein is activated, conjugated, or modified in the liquid mixture before being passed over the semipermeable membrane.

10. The method for purifying a protein according to claim 8, wherein the steps of washing and backwashing are repeated at least once.

11. The method of purifying a protein according to claim 8, wherein the ultrafiltration apparatus contains a diafiltration means.

12. The method of purifying a protein according to claim 8, wherein the semipermeable membrane has a molecular

weight cutoff selected from the group of 5,000, 15,000 and 30,000 and 100,000 dalton.

13. The method of purifying a protein according to a claim 8 further comprising sterile conditions.

14. In a method of producing a peptide-protein immunogen conjugate in which the peptide reagent is conjugated to a protein immunogen reagent and the product thereof is purified by ultrafiltration means, the improvement comprising coupling the peptide to the protein immunogen in a liquid mixture in a closed system, so as to produce a mixture of conjugated and unconjugated peptides and protein immunogens, and repeatedly subjecting the mixture to ultrafiltration, washing and backwashing the retained peptide-protein immunogen conjugate product so as to separate and purify the protein immunogen-peptide conjugate from the unconjugated peptide and protein immunogen reagents.